56TH CONGRESS, 1st Session. | SENATE. | DOCUMENT No. 226.

ROADS IN THE YELLOWSTONE NATIONAL PARK.

LETTER

FROM

THE ACTING SECRETARY OF WAR,

TRANSMITTING,

IN RESPONSE TO RESOLUTION OF THE SENATE OF MARCH 12, 1900, LETTER FROM THE CHIEF OF ENGINEERS, U. S. A., TOGETHER WITH COPIES OR ORIGINALS OF ALL REPORTS RELATING TO THE PRESENT CONDITION AND APPROPRIATE PLANS FOR THE DEVELOPMENT OF THE SYSTEM OF ROADS IN THE YELLOWSTONE NATIONAL PARK.

MARCH 16, 1900.—Referred to the Committee on Military Affairs and ordered to be printed.

WAR DEPARTMENT,
Washington, March 15, 1900.

SIR: In response to Senate resolution, dated March 12 instant, directing the Secretary of War—

to transmit to the Senate copies of all communications received by the Department from Hiram M. Chittenden, engineer in charge of improvements in the Yellowstone National Park, relative to present condition and appropriate plans for the development of the system of roads in said park,

I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, of yesterday's date, together with copies or originals of all reports relating to the subjects covered by the above-quoted resolution.

Very respectfully,

G. D. MEIKLEJOHN,
Acting Secretary of War.

The PRESIDENT PRO TEMPORE
OF THE UNITED STATES SENATE.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, March 14, 1900.

SIR: I have the honor to return herewith Senate resolution of March 12, 1900, "That the Secretary of War be directed to transmit to the

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I. WILSON,
ef of Engineers,
U. S. Army.

MISSOURI RIVER COMMISSION,
OFFICE OF THE SECRETARY,
St. Louis, Mo., April 6, 1899.

GENERAL: Referring to Special Orders, No. 70, paragraph 32, Headquarters of the Army, Adjutant-General's Office, Washington, D. C., March 25, 1899, assigning to my charge the engineering work in the Yellowstone National Park, I have thought that you might desire more specific information in regard to that work than was contained in my reply to your letter of inquiry dated February 18, 1899. I will, therefore, describe in detail what the conditions to be met are, and what is the usual method of meeting them.

Ordinarily the snow has disappeared sufficiently by the middle of May for wagons to reach the park plateau, which includes nearly all of the park south of Fort Yellowstone at Mammoth Hot Springs. It is not until some weeks later that the highest points in the road system can be crossed. From about May 15 to June 15 the roads are very soft, frequent washouts occur, and the work during this period is almost exclusively repair work and guarding against damages from freshets. It is presumably to meet the needs of this period that the sum of $5,000 of the present appropriation is made immediately available.

The regular work begins about July 1, and includes extensions or changes in the road system, or more extensive repairs than those already referred to. A project for this part of the work can be most intelligently prepared after the effects of the winter snows upon the roads are known. I am informed that the present season is one of unusual snow, and that the spring is very backward.

In conducting a work of this character from a distance it would be advisable to have an assistant with a party of moderate size on hand, the latter part of May, to render all possible assistance in opening and repairing the roads until settled weather comes. As soon as this is the case, ordinarily in the early part of June, it would be desirable for the officer in charge to inspect the entire system, form his plans on the ground, submit his project, and make the necessary preparations for a vigorous prosecution of the season's work as soon as the appropriation should be available. With this preparation, a competent assistant ought to handle the work alone. Probably not more than one more visit by the officer in charge, about the time that the work is at its height, say late in August or early in September, would be necessary.

These details are based upon the experience of two seasons' work in the park, and are submitted in the hope that they may be of service in making such arrangements as you may deem proper for the present season.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

MISSOURI RIVER COMMISSION,
OFFICE OF THE SECRETARY,
St. Louis, Mo., April 13, 1899.

GENERAL: In compliance with instructions contained in your letter of the 10th instant, I have the honor to submit the following project for the expenditure of the $40,000 appropriated in the sundry civil act of March 3, 1899, for the improvement of the Yellowstone National Park.

It is proposed to use the $5,000 which is made immediately available in opening up the roads for spring travel, cutting out snow drifts, repairing culverts, in guarding against damages from freshets caused by melting snow, and in putting the roads generally in good repair.

The balance of the appropriation it is proposed to use in making permanent repairs to the roads by the use of gravel and broken stone, in altering the course over short stretches where it can be done to advantage, in building a light bridge across the Yellowstone River near the falls, to give access to the right bank of the river in that vicinity, and in the location of that part of the approved road system not yet constructed, which extends from the Grand Canyon to near the mouth of Lamar River.

The details of this proposed work can not be determined until after a personal inspection, which will be impracticable earlier than the month of June.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 17, 1899.

Respectfully submitted to the Secretary of War.

The sundry civil act, approved March 3, 1899, provides as follows:

Improvement of the Yellowstone National Park: For the repair and maintenance of existing roads and bridges and improvement and protection of the Yellowstone National Park, to be expended by and under the direction of the Secretary of War, including not exceeding five thousand dollars to be immediately available, forty thousand dollars.

By paragraph 32, Special Orders, No. 70, Adjutant-General's Office, current series, Capt. Hiram M. Chittenden, Corps of Engineers, was

placed in charge of the work of road improvement in the Yellowstone National Park.

In the within project Captain Chittenden recommends the expenditure of the $5,000 made immediately available in opening up the roads for spring travel, and the balance of the appropriation in repairing, improving, and extending the road system of the park, the details of the work to be determined after a personal inspection.

It is recommended that this project be approved, subject to such changes in details by the Chief of Engineers as may be found expedient during the period of active operations.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
April 20, 1899.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,
Chief Clerk.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 21, 1899.

Respectfully returned to Captain Chittenden, inviting attention to the preceding indorsements.

To be returned.

By command of Brig. Gen. Wilson:

JOSEPH E. KUHN,
Captain, Corps of Engineers.

[Fourth indorsement.]

ST. LOUIS, MO., *April 24, 1899.*

Respectfully returned to the Chief of Engineers, United States Army, contents being noted.

H. M. CHITTENDEN,
Captain of Engineers.

MISSOURI RIVER COMMISSION,
OFFICE OF THE SECRETARY,
St. Louis, Mo., May 4, 1899.

GENERAL: Before going to the Yellowstone Park, under the orders from your office of April 29, 1899, I desire to submit to you, for your action, the details of the bridge which I would propose for the crossing of the Yellowstone River above the upper falls.

At present there is no bridge across the Yellowstone River in its whole length through the park except an old wooden structure on the Cooke City road near the north boundary, a section not visited by the tourist. It has never been possible to get to the east side of the river at any other point except by fording (at extreme low water) or by boat. The right bank of the Grand Canyon, which is the principal scenic part of the park, has thus always remained excluded from the sightseer.

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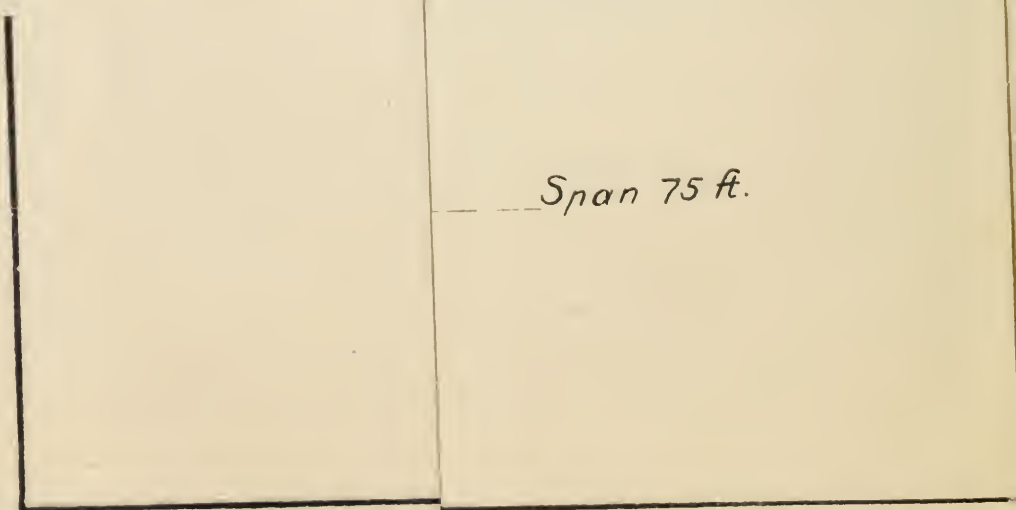
Span 75 ft.

A bridge has long been proposed at this point, and the extremely contracted channel of the river here makes it a comparatively cheap and easy undertaking to build one. In 1892 I personally made a careful survey of the locality at the head of the upper falls with a view of preparing plans for a bridge at that point, and I am quite familiar with the situation. The banks are abrupt and composed of rock *in situ*, and in one place the opposite ledges approach each other within 47 feet. It is here that I would propose a bridge. It is the most convenient place to the public, and the easiest place to build a bridge. Others have been proposed near the head of the rapids, but this would cause a detour of two miles to reach the lower falls, or the Grand Canyon. (I may say that the lower fall is about half a mile below the upper, and that the hotel is near it.) My judgment then was, and now is, that the situation just described is the place for the bridge.

As the situation is one of magnificent scenery, it has always seemed to me that any common form of bridge, like a truss of wood or iron, would be out of place. In 1892 I was planning a rustic masonry arch, but the cost would be prohibitory. The development of the Melan arch construction, however, affords a satisfactory solution, for it permits the combination of æsthetic design, great strength, and low cost.

I submit a drawing showing the structure I would propose. It may be modified somewhat as to length of span upon a more careful study of the site, but not in essential details. I ask your consideration of the design before I go to the park, in order that I may act at once as soon as I have reexamined the site. The concrete work ought to be done not later than August 31, on account of frost in September, and prompt work will be required to assemble the material and get the work under way by that time. The distance from Washington is so great that it would cause much delay to wait for approval after my visit to the park.

As to the cost of the bridge, it would cost here not more than $4,000. In fact, a bridge, of which I enclose a description, built in Forest Park, of this city, of four-fifths the span and four times the width of that herein proposed, cost only $5,000. The work will of course be much more expensive out there on account of having to haul the material a distance of 50 miles from the railroad. The weight to be so hauled will be about 45 tons, and at $20 a ton will add $900 to the cost for this item alone. The expense for freight will not be excessive, because the Government is entitled to half rates over the Northern Pacific, and that railroad being largely interested in the park, has given even better rates than this. The cost of royalty for the Melan patent will be merely a nominal sum of $10.

I can therefore recommend this design of bridge as by far the best adapted of any to the situation, and I have the honor to request your approval of it, in order that I may proceed with the work as soon as I arrive on the ground.

The construction of a bridge at this point was included in my project of April 13, 1899, for the season's work.

The false work for the bridge will be suspended from the arched girder, because,

(1) it is impossible to build it in the stream, and

(2) it will bring the strain on the iron before the concrete sets, and will avoid settlement when the false work is removed.

The iron is of strength sufficient to sustain the bridge load with four feet of solid ice on top of it, on the supposition that the concrete has no arch strength in itself. As a matter of fact, the concrete arch would make a strong bridge without the iron. The combination, therefore, gives an exceptionally safe structure—a very important matter in so dangerous a situation.

I inclose three photographs* showing the situation where it is proposed to build the bridge. No. 1 is the upper fall of the Yellowstone, No. 2 is a view of the rapids above the fall, and No. 3 was taken by myself in 1892, and is a view of the gorge looking down stream just above the brink of the fall. The proposed bridge site appears on each. I also inclose two clippings* from the Engineering News, showing actual applications of the Melan arch construction. I request that the photographs and clippings be returned.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 8, 1899.

Respectfully returned, approved.

Captain Chittenden is authorized to retain the photographs and clippings, returning this paper and the blue print to this office after the necessary record.

By order of the Acting Chief of Engineers.

JOSEPH E. KUHN,
Captain, Corps of Engineers.

[Second indorsement.]

ST. LOUIS, MO., *May 10, 1899.*

Respectfully returned to the Chief of Engineers, United States Army, necessary record having been made.

H. M. CHITTENDEN,
Captain of Engineers.

IMPROVEMENT YELLOWSTONE NATIONAL PARK,
UNITED STATES ENGINEER OFFICE,
St. Louis, Mo., June 21, 1899.

GENERAL: I have the honor to report that, in compliance with instructions contained in your letter of May 8, 1899, I left this city on the 22d ultimo for the purpose of assuming personal charge of the public work in the Yellowstone National Park, and arrived at Mammoth Hot Springs, Wyo., the headquarters of the park work, on the 27th ultimo. My first care was to arrange the transfer of funds and property and the division of the new appropriation between the works of protection and improvement of the park. This was accomplished without material hindrance, and I then devoted my time continuously to plans for the work of the current season.

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* Not printed.

I found the season late beyond any precedent in the history of the park. On the 13th instant, only two days before the arrival of over 100 tourists, I passed over portions of the road system where for nearly 8 miles in a continuous stretch the road had to be shoveled through the snow, which lay not less than 3 feet deep on the level. The snow was so compact that it was probably equivalent to not less than 6 inches of water. This condition involved so much danger to the canyon roads, which are liable to be washed out if the snow should melt quickly under the action of hot air or rain, that I did not feel it prudent to undertake any important new work until the danger of floods is past. For this reason I found it imperative to defer for the present season the construction of a bridge over the Yellowstone for which your authority was obtained under date of May 8, 1899. Instead, I concluded that the best application of so much of the appropriation as may be available for new work would be the construction of a new road up what is known in the park as the Golden Gate Hill. This hill is about 1,000 feet high, but on account of frequent losses of grade by descents in the course of the general ascent the total height raised must be at least 1,400 or 1,500 feet. Some of the pitches on the hill have grades exceeding 20 feet in the hundred, and besides being very severe on stock, are always a cause of alarm to tourists. Several accidents have already occurred here. The hill is at the very beginning of the park tour and makes an unfavorable impression which the easy grades on the rest of the road system do not entirely remove.

It has long been the intention to alter this road, and it seemed to be the most urgent work at present requiring to be done. I accordingly selected a line down the hill with easy grade all the way and personally marked it out. I have hired a competent engineer to lay out the grades and direct the working parties, and hope to complete the work during the present season. The distance is about 3 miles. Before leaving the park I invited the acting superintendent, the president of the Yellowstone National Park Transportation Company, and one of the owners of the Monida and Yellowstone Stage Line to view the proposed location. All expressed themselves as entirely satisfied with it.

If, after the completion of this work, funds still remain, the best place for expending the balance will then be decided on.

Having arranged all matters connected with the season's work, and having gotten everything into satisfactory working order, I left the park on the 15th and arrived at this place on the 20th instant.

I do not think that it will be necessary for me to visit this work but once more during the season unless some unforeseen contingency arises. I should like to return to the park about the 1st of August and stay there about four weeks, or such time as may be found necessary. I desire to go via Monida, Mont., and return via Jackson Lake, Wyoming, in order to afford me an opportunity of inspecting the western and southern entrances to the park, neither of which have I seen since the new roads were constructed.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 23, 1899.

Respectfully returned approved.

The necessary travel orders will be issued to Captain Chittenden upon receipt of timely application therefor prior to his next visit to the park.

To be returned.

By command of Brig. Gen. Wilson:

JOSEPH E. KUHN,
Captain, Corps of Engineers.

[Second indorsement.]

IMPROVEMENT YELLOWSTONE NATIONAL PARK,
U. S. ENGINEER OFFICE,
St. Louis, Mo., June 27, 1899.

Respectfully returned to the Chief of Engineers, U. S. Army, necessary record having been made.

H. M. CHITTENDEN,
Captain of Engineers.

UNITED STATES ENGINEER OFFICE,
Sioux City, Iowa, February 27, 1900.

GENERAL: In conversation with Senator Carter, of Montana, when I was in Helena last December, he suggested that I prepare a careful statement of the requirements of the Government work in the Yellowstone National Park, with particular reference to the estimates for the next fiscal year. He said that he should call upon the Secretary of War for such information and hoped that I would have it ready. Acting upon this suggestion, I have prepared a condensed statement, taking up each item in the estimate and explaining the necessity for it. So far as possible I have illustrated by photographs the several situations, so that the present condition of the work may be more easily understood. I have also added some suggestions in regard to the next appropriation. This statement was completed when the communication of the Secretary of the Interior to the Secretary of War, dated February 15, 1900, was referred to me for my information and for remark. As the subject-matter of the Secretary's communication was fully discussed in the statement above referred to, I transmitted a copy with my indorsement returning the letter.

I inclose herewith a duplicate, and hope that these two copies may be placed before the committees of the two Houses having the park appropriation in charge, if there is no impropriety in so doing.

I have made an effort to place the park work upon a basis which will give the best results for the money expended and which will lead to an early completion of the project; and knowing that the situation out there is but imperfectly understood by any one who has not been there, I have thought that some information in addition to that contained in the annual report would be of value to the committees of Congress.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

ESTIMATE FOR COMPLETION OF PROJECT FOR IMPROVING YELLOWSTONE NATIONAL PARK.

[Extract from Annual Report of the Chief of Engineers, U. S. A., for 1899.]

Below is an estimate of the amount required for the *completion* of the existing project after the work of the present season is done:

(1) New road in Gardiner Canyon, including three steel bridges	$10,000.00
(2) Road through Golden Gate Canyon, including new steel bridge to replace wooden bridge around cliff, and widening road along cliff, the latter all solid rock	15,000.00
(3) Raising 3 miles of road in Gibbon Canyon and cutting out 1 mile of dangerous grades; also opening 4 miles of new road down the Gibbon to connect with the western approach	16,000.00
(4) Completion of 8 miles of road near Fountain Hotel	8,000.00
(5) Completion of southern approach along Snake River, 20 miles	20,000.00
(6) New road from West Thumb to Natural Bridge, cutting out present line around Lake Shore, 8 miles	16,000.00
(7) Surfacing new road from Lake Hotel to Grand Canyon, 15 miles	15,000.00
(8) New bridge across the Yellowstone, near the falls	20,000.00
(9) New road down right bank of Grand Canyon, 3 miles	6,000.00
(10) New road near Grand Canyon to cut out dangerous hills	5,000.00
(11) New road, Canyon to Norris, 10 miles	20,000.00
(12) New road, Grand Canyon via Tower Falls to Mammoth Hot Springs, 36 miles	72,000.00
(13) New bridge over Yellowstone near Tower Falls	10,000.00
(14) New bridge over Lamar River	5,000.00
(15) Completion of east approach, 15 miles	15,000.00
(16) New plant	5,000.00
(17) New office and other buildings	5,000.00
(18) Current repairs and maintenance for season of 1900	10,000.00
(19) New bridges at various points, six needed at once	12,000.00
(20) Office, transportation, and miscellaneous expenses	10,000.00
(21) There should also be added for clearing out and rendering more easily passable the numerous trails throughout the park, which are essential to its proper police and protection	5,000.00
Total for complete project in a single season	300,000.00

The superintendent has submitted to me the following estimate of improvements which have become necessary to facilitate his work in protecting the park:

Two new station houses for troops at detached points in the park	$1,912.50
Four and one-half miles of fence along north boundary to keep game in and cattle out, in the vicinity of the village of Gardiner, Mont	3,250.00
Station house and entrance gate at northern entrance of park, where tourists mostly arrive	1,200.00
Surveying, monumenting, and otherwise marking boundaries, 59 miles, at $75	4,425.00
	10,787.50
Total appropriation recommended for next fiscal year	310,787.50

EXPLANATION OF ESTIMATE.

Item 1. New road in Gardiner Canyon, including three steel bridges $10,000.00

This involves the relocation and reconstruction of about one mile of new road and the construction of three steel bridges like the one just built over the Gardiner. (See photograph.) The present road is very dangerous, and impossible to maintain, on account of the unstable cliffs which overhang it and drop rock into the road at every storm. It was filled with mud and rock to the depth of 1 to 4 feet in twenty minutes during a storm on the evening of August 6 last. The road is too narrow for teams to pass each other, and there is constant danger of accident. One life has been lost here, and one loaded coach overturned here last season. The road must be placed on the other side of the river. The construction will be difficult and costly. The road is the most used of any in the park, and its improvement as above outlined is an imperative necessity. The work has long been contemplated, but the money has never been available. (See photographs 1, 2, 3, and 4.)

Item 2. Golden Gate Canyon $15,000.00

Road through this canyon is mostly cut in side of cliff. For 200 feet it passes over wooden bridge. This bridge is about fifteen years old and has reached its limit of safety. It will have to be condemned by the close of another season. The situation is such that an accident here would have appalling consequences. It is proposed to put in a series of concrete arches, covered with a regular macadam roadway 16 feet wide, with a solid parapet 3 feet high. The cost will be in the neighborhood of $10,000. (See photographs 5, 6, 7, and 8.)

The road through the canyon is in most places too narrow for teams to pass each other, and there are two short turns where the view ahead is abruptly and completely cut off. It is proposed to widen the road so that it shall everywhere be passable by two teams abreast, and to make it much wider at the sharp curves. At the same time the steep grade will be eliminated and the whole made to conform to the grade and approaches of the new bridge. This will all be solid rock work and very costly—about $5,000 for the whole work. (See photographs 9 and 10.)

Item 3. Gibbon Canyon road $16,000.00

There still remains on this part of the road system about a mile of the original wagon trail not yet replaced by a good road. It includes two very steep hills, one of them with a sharp curve at the foot immediately on the bank of the river. The failure of brakes or any other mishap which might bring a team at the foot of the hill at high speed would inevitably precipitate the conveyance into the river. This stretch of road must be classed as dangerous.

The main road through the Gibbon Canyon is one of the most pleasing in the park. It runs immediately along the bank of the river and is of easy grade. Unfortunately it is not built high enough above the river to make it safe. The river at every heavy flood goes clear over the road and has washed it out twice in the past six years. It is proposed to raise this road from 2 to 3 feet and make it safe against floods. (See photographs 11 and 12.)

A road is needed to connect the Gibbon Canyon with the road down the Madison to cut off a long detour for traffic going in that direction. The development of travel via the western approach has made this cut-off of great importance. This work involves the construction of a bridge over the Gibbon.

Of the above three pieces of work in the Gibbon Canyon the first two are of immediate and pressing urgency, and the third is very desirable at an early date. The whole work has been estimated as equivalent to 8 miles of new road at $2,000 per mile.

Item 4. Roads near Fountain Hotel $8,000.00

These roads are already graded, but mostly with soft geyserite material, which forms an impassable quagmire in wet weather, and is unendurable on account of suffocating dust in dry weather. A large part of this stretch of road is not now used, the coaches preferring the natural roads on the prairie. These roads should be thoroughly graveled. The work ought to be done at once. It is estimated to cost $1,000 per mile.

Item 5. Snake River road $20,000.00

This road is merely grubbed and cleared, with trees and stumps left in middle of roadway most of the distance. The whole road is in a wretched condition and a disgrace to the Government. Travel from the south is rapidly increasing and the completion of road is urgently needed. The above estimate is about $1,000 per mile and will barely accomplish the work required. (See photographs 13, 14, and 15.)

Item 6. Natural Bridge Cut-Off $16,000.00

This work is to replace about 12 miles of road around shore of lake by 8 across peninsula. A portion of the present road lies along the beach of the lake and has been so much injured by the lake that it is now abandoned. The remainder of the road lies back in the woods out of reach of the lake and is mostly built over uneven and sandy ground. It forms the most monotonous drive in the park. The cut-off will reduce the distance four miles, cut out the ruined beach road, give a better road, and pass directly by Natural Bridge, which can now be reached only by a separate drive. This work, though not of imperative necessity, is very important, and should receive early consideration. Being all new work, it is estimated at the average cost of such work in the park, $2,000 per mile.

Item 7. Yellowstone River road $15,000.00

This length of 15 miles is one of the best-graded roads in the park, carefully laid out by instrumental survey, and equal in this respect to any road in the world; but the material of which it is made is for the most part utterly worthless. The road becomes practically impassable in wet weather, and well nigh intolerable from dust in dry weather. It must be surfaced with rock or gravel. The work is urgently needed and should be done during the next season. It is estimated to cost $1,000 per mile.

Item 8. Bridge above rapids of Yellowstone $20,000.00

This work has long been of urgent importance. The public is still (twenty-seven years after creation of park) entirely shut out from views on right bank of the Yellowstone. The superintendent has to send his patrols, for protecting the eastern part of the park, via Baronet Bridge, in extreme north of park. The patrols at Grand Canyon and Yellowstone Lake can render no service in protecting the country on the east bank of the river. The bridge is thus a necessity both to the traveling public and for the proper police of the park. Being in one of the grandest situations in the entire park, its design and construction should conform to the surroundings. No cheap iron or wooden structure should be considered. It is proposed to adopt the construction known as the Melan arch, a combined steel and concrete structure, in which great strength, artistic design, and reasonable cost can be combined. The whole structure has been worked out in detail, and with the approaches, grading, etc., will cost very close to the above sum. (See photographs 16, 17, and 18.)

Item 9. New road on right bank of Grand Canyon $6,000.00

This road is to connect with the bridge (previous item) and give access to right bank of Grand Canyon for about 3 miles below bridge.

Item 10. New road near Grand Canyon $5,000.00

The present road is one of the hardest to maintain in the park. It has steep grades, is very narrow, and is held up by loose retaining walls which are constantly caving in. The material is also very bad and cuts all to pieces in wet weather. It is proposed to bridge Cascade Creek farther upstream and carry the road to the hotel at a higher level. This work will greatly relieve the task of maintenance in this vicinity.

Item 11. Road from Norris to Grand Canyon $20,000.00

This road has three of the worst and most dangerous hills on the entire system. The Virginia Cascade hill is a positive menace to the lives of travelers. Several accidents have occurred here, and one life has been lost. Stage drivers are often compelled to make passengers alight and walk down hill. The "Devil's Elbow"—a very short turn of nearly 180°—is another dangerous place. Blandon hill is a long, difficult, and dangerous ascent, which it is impossible to maintain in good condition. The long hill descending into the valley of the Yellowstone is composed of wretched material, which so cuts up in wet weather as to be impossible of ascent by loaded wagons. The dense forests on top of the plateau retain the snow so late that it has to be shoveled out every spring at great expense. It is proposed to cut out some of the hills, reduce the grades on others, surface the bad stretches, and clear the timber away on the north side of the road so as to let the sun in. This work is of pressing importance, as the road will always be extensively used, even after the Washburn road (see next item) is completed. It is estimated to cost as much as an entire relocation, or about $2,000 per mile for 10 miles. (See photographs 19, 20, 21, 22, 23, and 24.)

Item 12. The Mount Washburn road $72,000.00

This is the only extensive portion of the park road system that is still untraveled. Although it will be one of the most interesting and attractive parts of all, it has never been possible, in a period of over twenty-five years, to get money to undertake it. It is a great source of disappointment to all tourists that this section of the park is shut out to them except on horseback. That portion of the road extending from near Baronet Bridge to Mammoth Hot Springs is a part of the road leading from Gardiner to Cooke City through the park. As is well known, Cooke City has made a long and strenuous fight to get a railroad along this line, but the Government has wisely refused this privilege. In thus refusing, however, there is something of an obligation resting on the Government to provide at least a respectable highway for travel which has to follow this route, particularly as it does not permit private parties to build roads in the park. The road, moreover, has long been a postal route from Mammoth Hot Springs to Cooke City. This road, therefore, is required for the

double reason of forming a part of the regular tourist route and providing a necessary commercial highway across the park. The present road is one of the most difficult and dangerous to be found in all the Rocky Mountains, and it is a discredit to the Government that travel over any part of the park has to be made, at this late day, over such a thoroughly wretched road. The entire work is of immediate and pressing importance. It is all new work, and is estimated at $2,000 per mile. (See photographs 25 and 26.)

Item 13. Bridge over Yellowstone $10,000.00

This is to replace the old Baronet Bridge, which has now reached its limit of safety and will have to be condemned at an early date. It is even now unsafe for heavy loads. It is proposed to replace it with a permanent steel bridge on masonry abutments—span 100 feet. Cost estimated includes approaches. This work must be done during the next season or the bridge be abandoned. It is a very important crossing and is the site of the oldest bridge over the Yellowstone River. (See photograph 28.)

Item 14. Bridge over Lamar River $5,000.00

A very important structure on road to Cooke City. Difficult to maintain unless a good bridge is built. Lamar River subject to greater floods than any other stream in the park. Bridge at present site has washed out three times in past six years. Can not be held where it is. New location and new bridge immediately needed. Steel structure with masonry abutments proposed. (See photographs 27, 29, and 30.)

Item 15. Cooke City road $15,000.00

This connects with the main tourist route at the Yellowstone Bridge (item 13) and extends to Cooke City. A part of the road in Soda Butte Canyon has been partly constructed, leaving upward of 15 miles to be built. This will have to be done when the new bridges are built, for the new road will not follow the old one, the bridge sites being differently situated. Remarks under item 12 apply to this road. It is of the greatest usefulness also in patrolling and protecting the entire northern portion of the park, which is the most important game preserve on the reservation. Work much lighter than the average and is estimated at only $1,000 per mile.

Item 16. New plant $5,000.00

This includes a portable rock-crushing outfit, a road roller, a steam derrick, concrete plant for bridge abutments, road machines, scrapers, plows, shovels, etc.

Item 17. New office, etc $5,000.00

The park work can not at present be said to have either office, storehouse, or quarters. The building used for an office is the flimsiest sort of a structure through which dust, wet, and cold, according to the season, find their way with the greatest ease. The officer in charge and all the clerical force have only a single room some 15 feet square. The back of the building is used to store subsistence supplies. The building on right of office is a storehouse for tools—also a cheap structure. The building on left of office is the quarters for the office employees. In rear are several shacks and sheds used for mess house, blacksmith shop, and storehouse. (See photograph 31.)

There should be a small, well-built office building, and a large warehouse and mess house combined. This improvement is urgently needed, but it has never been possible to save enough money out of any appropriation to make it.

Item 18. New bridges $10,000.00

Besides the bridges included in above estimate, there are immediately required two large ones on the Snake River road, one over the Gibbon, one over Nez Perce Creek, one over Tower Creek, and two on road between Tower Creek and Mammoth Hot Springs. There are many other smaller bridges covered in the above estimate, but the six here referred to are all large and important structures, and are therefore separately estimated for.

Item 19. Miscellaneous, office, transportation, etc $10,000.00

The item of transportation here referred to relates to the hauling of supplies to the various working parties. It is a very heavy, but wholly unavoidable, element in the cost of the park work, where all supplies have to be hauled from 10 to 100 miles from the railroad. The amount is based upon the work proposed to be accomplished under above general estimate.

Item 20. Current repairs, etc $10,000.00

This is required for opening the roads in the spring, by repairing bridges, culverts, and washouts, and for maintaining the system during the season. It is based on an

estimated cost of $100 per mile per year for roads on which no other work is being done. This is in the nature of a fixed annual charge for maintenance, and in the draft of bills given below is separately specified.

Item 21. Trails $5,000.00

These play a most essential part in the protective work of the park. They reach the localities remote from the tourist route and comprise several hundred miles. They are not maintained in as good condition as they used to be, for the reason that all the funds in recent years have gone into the roads. They require thorough clearing out and improving in the bad places.

Item 22. Protection $10,787.50

All the items included under this head are of the greatest importance to the protection of the park, and the superintendent's estimate is none too high for the work proposed.

The foregoing estimate is based upon a careful examination by the officer in charge of the entire ground to be covered, and upon careful surveys and detailed estimates of the more important situations. It is an estimate for the final *completion* of the existing project for the improvement of the park. The macadamizing of the roads, the clearing away of brush, and other matters relating to the perfection and embellishment of the system can be deferred for the present, to be carried out under the fixed annual charge for maintenance. *When the work contemplated under this estimate is done, the annual cost of the park road system will drop at once to the necessary outlay for maintenance, which ought not to exceed $100 per mile per year. The prompt completion of the project will, in fact, save the Government enough to maintain the system for many years to come, for it is certain that to carry out the work as at present, with such small appropriations, leaving the work often in an uncompleted state, in which it is so damaged every year by the elements as require doing over in large part, will cost the Government not less than $500,000. That this is a conservative estimate of the waste involved in the present system of appropriations can be rigidly demonstrated from the history of the work.* It is, therefore, not merely for the convenience of the public, but decidedly to the economy of the work that it should be completed promptly, under such assurances of forthcoming funds as will enable the officer in charge to carry out the programme of work without liability of interruption. To accomplish this it will be necessary for Congress to authorize—by contract or otherwise—an annual outlay for new work of $100,000. This will complete the project in three years, and will enable the officer in charge of the work to plan its execution with the certainty of having it carried on continuously to completion. While the character of the work is such that in some places it can best be done by hired labor, there are others where it can best be done by contract, and the appropriation should permit either method to be used, as may be most advantageous.

MAINTENANCE.

The construction of the park road system has now progressed far enough so that the matter of maintenance should be considered separately and apart from the new work. To that end it is desirable that the act making the appropriations contain separate items for these two purposes. In case the estimate for the present year is allowed, there will be considerable work of reconstruction along portions of the existing roads, but there will still remain about 100 miles of roads where only maintenance and repairs will be required. At $100 per mile this will make $10,000, the amount contained in the estimate.

PROTECTION.

The police duty of the park is a matter separate and distinct from the improvement work. The funds for the first purpose are disbursed by the acting superintendent under the Secretary of the Interior; those for the second by an engineer officer, through the Chief of Engineers, under the Secretary of War. The appropriation for purposes so distinct and unlike should be separately provided for. In the case of the last annual appropriation it was necessary to make allotments for the two purposes based upon a conference between the acting superintendent and the engineer officer. Such an arrangement is not a good one and is liable to lead to difficulty and misunderstanding. It will be better for Congress to settle this matter itself.

There is given below a draft of a bill which embodies the suggestions herein contained. The continuing contract clause is in the exact phraseology of similar provisions in the river and harbor lists.

FOR THE IMPROVEMENT AND PROTECTION OF THE YELLOWSTONE NATIONAL PARK.

"For the construction of roads and bridges, in accordance with the existing project as published in appendix to the Report of the Chief of Engineers, 1899, pp. 3863–3868, to be expended by and under the direction of the Secretary of War, one hundred thousand dollars: *Provided*, That the Secretary of War may enter into a contract or contracts for such work and materials as may be necessary for the completion of the existing project, or the materials may be purchased and the work done otherwise than by contract, to be paid for as appropriations may from time to time be made by law, not to exceed in any one year one hundred thousand dollars, and not to exceed in the aggregate two hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated.

"For the repair and maintenance of existing roads and bridges, during the fiscal year ending June 30, 1901, to be expended by and under the direction of the Secretary of War, including not exceeding five thousand dollars to be immediately available, ten thousand dollars.

"For the protection of the Yellowstone National Park, to be expended by and under the direction of the Secretary of the Interior, ——— dollars."[1]

It is proposed to apply the first year's appropriation, as far as it will go, to those items in the above estimate which are most urgently needed. It is better to make the appropriation by lump sum, as above, rather than by items, as given in the estimate; for while the amounts given are closely approximate, conditions may be encountered which will increase the cost here and diminish it there, and it will be better that the appropriation have sufficient elasticity to meet these varying conditions as they arise and permit the application of the money where it will be most effectual.

It has been stated by some that not more than $50,000 can be spent economically in one season on the park work. This is wholly a mistake. The distribution of working parties is such that the amount of work carried on can be multiplied indefinitely with no modification of the present system of conducting it, except an increase in the administrative force. In fact, the most effective season's work ever carried through in the park was in the year 1891, in which two appropriations, aggregating $150,000, were available.

It is important to emphasize the fact, that while the annual appropriations for the park have kept on at the same figure from year to year, the road system has gradually expanded, the cost of maintaining it has increased, and large portions have been so neglected that it has now become a question of radical repairs or total abandonment. Such extensive and costly works as the Gardiner Canyon road, the Golden Gate bridge, and the several bridges in other parts of the park that must be built, can not be carried out under the present annual allowance. They are now not merely desirable for improvements, but absolutely necessary if the system is to be kept open.

Below are some statistics showing the amount of business annually transacted over the park road system. It is safe to say that any navigable stream in the United States that could boast of a business like this would receive large consideration at the hands of Congress.

Statistics of business transacted in the Yellowstone National Park during the tourist season of 1899.

The total number of tourists visiting the park was very nearly 10,000, or, in exact figures, 9,772.

Name of business concern.	Passenger miles or number of passengers hauled 1 mile.	Mile tons or tons of freight hauled 1 mile.	Money value of business transacted.
Yellowstone Park Association	.....	16,077	$120,000.00
Yellowstone Park Transportation Co	549,000	7,098	74,925.00
Monida and Yellowstone Stage Co	66,330	3,760	11,139.00
Wylie Camping Co	210,000	7,200	40,000.00
Yellowstone Lake Boat Co	77,650	31,500	40,000.00
Camping parties	852,890	.....	.....
Miscellaneous business	.....	8,547	23,584.35
Quartermaster Department	.....	11,870	.....
Engineer Department	.....	2,798	.....
Total	1,755,870	88,850	276,148.35

[1] Of the last annual appropriation of $40,000 there was allotted for improvement $35,000 and for protection $5,000.

These estimates were all submitted to the acting superintendent of the park for such suggestions as he might desire to make, and have received his unqualified approval, with special emphasis upon the following items. He says:

(*1*) *Gardiner Canyon.*—"This road for a certain distance runs at the base of precipitous mountains, the side next to the road being composed of loose soil and an easily disintegrated stone that from time to time break away and fall into the road, making travel along this part extremely dangerous. This should be changed in accordance with your plans as a measure of safety, as practically all tourists pass over this road."

(*2*) *Golden Gate Bridge.*—"This is absolutely necessary for safety. I do not consider the present bridge safe for another season's travel, and should it, upon examination in the spring, be found unsafe, I should have to prohibit passage across it. This, as you know, would stop all travel in the park. Of course, it might be patched up in some way, but this is a dangerous place and a new bridge is what is required."

(*13*) *Lower Yellowstone Bridge.*—"This is an old, insecure bridge, and is the only way of getting into the northeastern part of the park and over the Cooke City road to Soda Butte, where I have a permanent detachment stationed. For the protection of game in this part of the park, it is not only necessary to keep a detachment at Soda Butte all of the year, but frequent detachments must be sent from the post in addition, so this bridge is constantly in use. Lieutenant Hickman has just (late in November) returned from Soda Butte and reports that he considers the bridge unsafe."

(*14*) *Lamar River Bridge.*—"The necessity for this is exactly the same as for the bridge at Tower Falls, as they are both used in covering the northeastern portion of the park by the military and for civilian travel into the park from this direction. The bridge was washed out by high water last summer, cutting off all communication for several days; this, with the present style of bridge, will probably happen every year during high water."

(*18*) *General Repairs.*—"Your estimate for $10,000 for certain repairs and maintenance for the season of 1900 I consider absolutely necessary."

FIG. 1.—STEEL WAGON BRIDGE, CONCRETE ABUTMENTS. ERECTED 1899.

FIG. 2.—OLD WAGON BRIDGE REPLACED BY STEEL BRIDGE.

FIG. 3.—SIDE VIEW OF THE NEW STEEL BRIDGE.

FIG. 4.—GARDINER CAÑON ROAD ON RIGHT, UNDER UNSTABLE CLIFF.

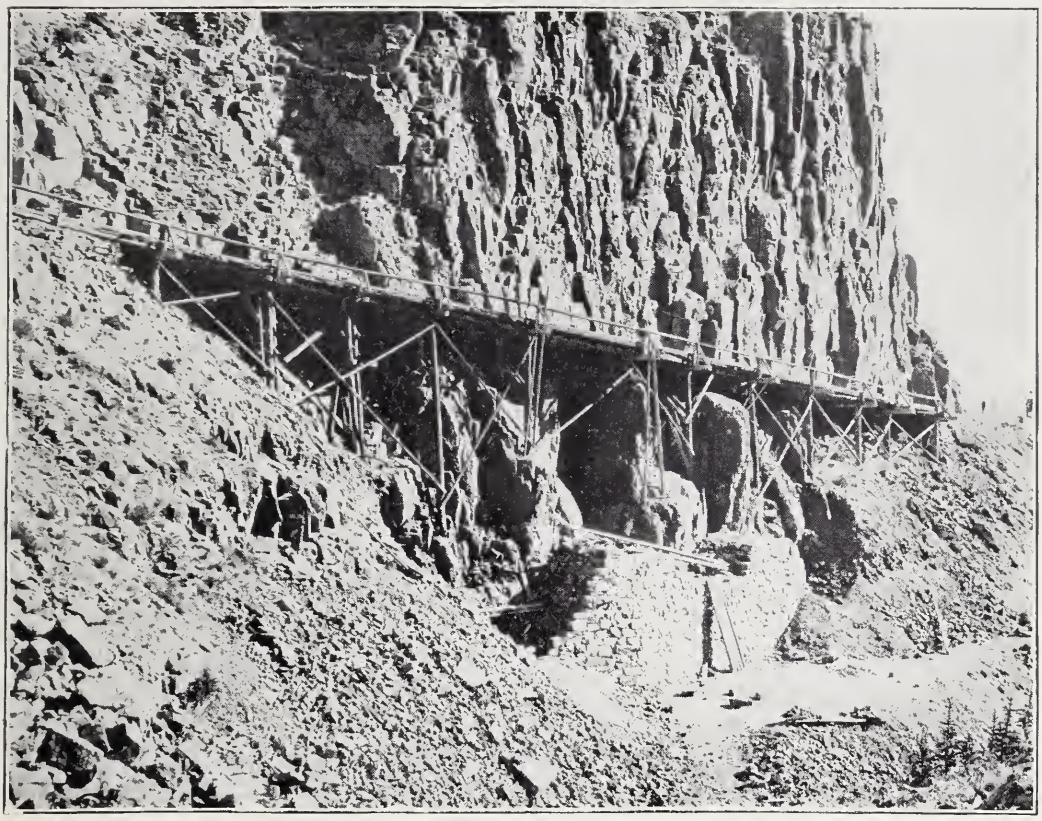

FIG. 5.—OLD GOLDEN GATE BRIDGE. MUST SOON BE ABANDONED.

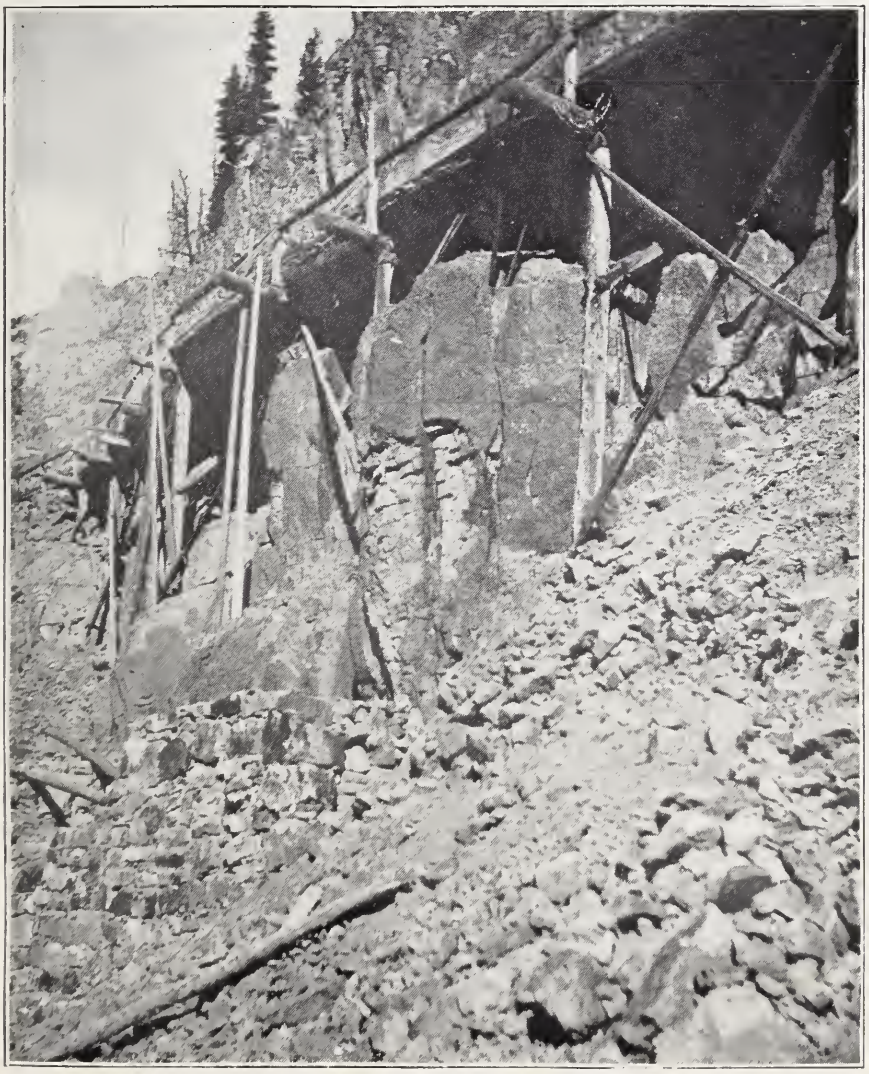

FIG. 6.—OLD GOLDEN GATE BRIDGE.

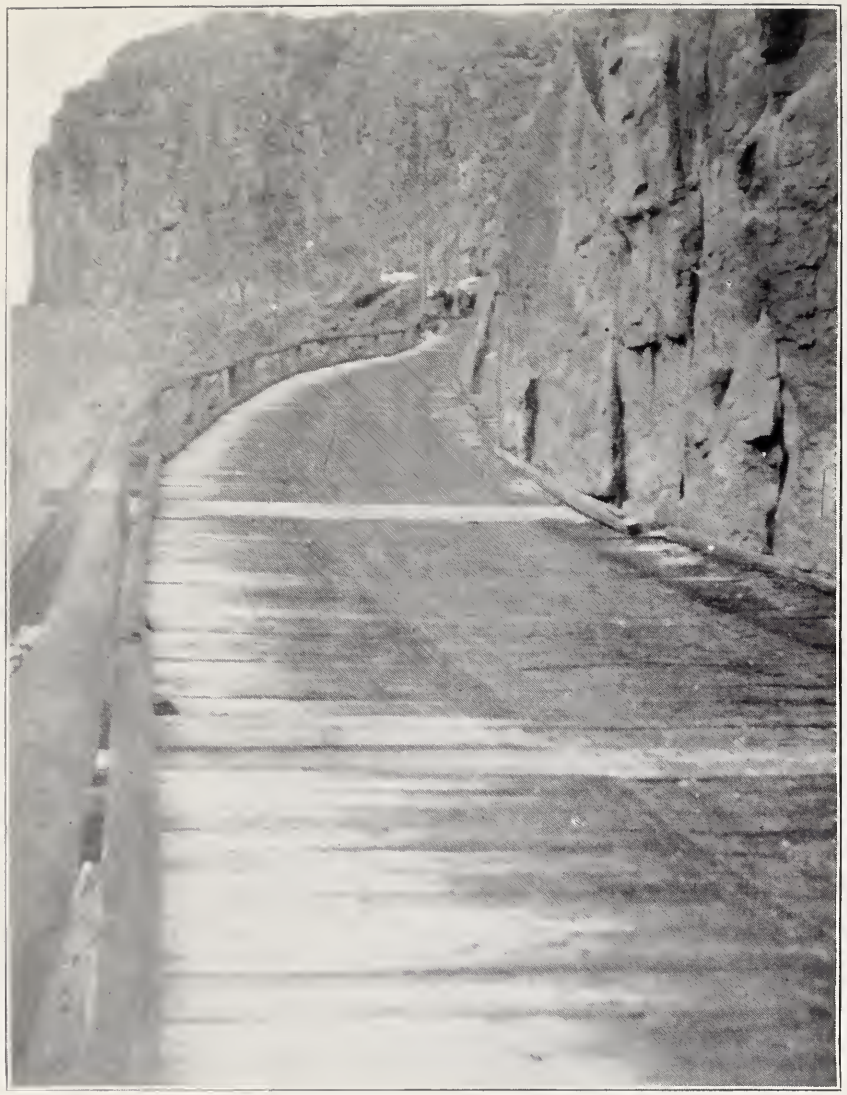

FIG. 7.—OLD GOLDEN GATE BRIDGE. TOP VIEW.

FIG. 8.—OLD GOLDEN GATE BRIDGE. ENTRANCE FROM UPPER END.

FIG. 9.—SHARP CURVE AND NARROW ROAD. GOLDEN GATE CAÑON.

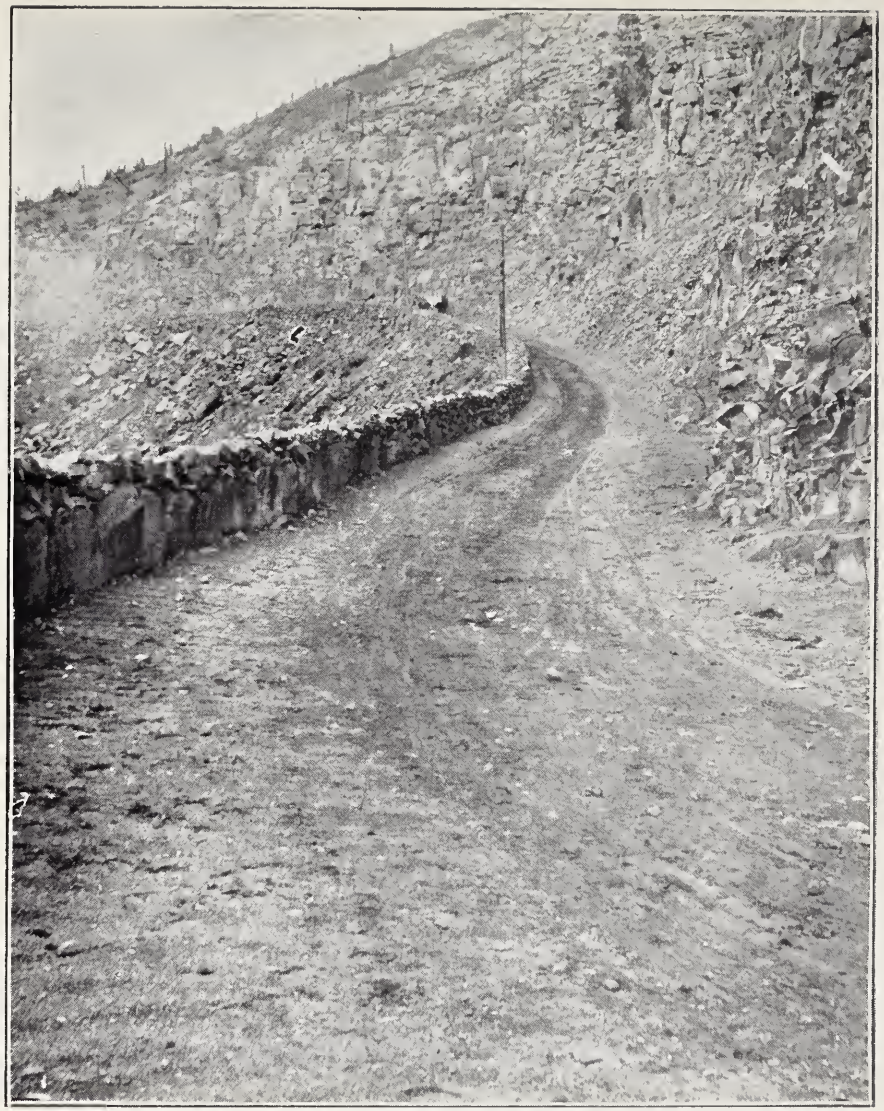

FIG. 10.—STEEP GRADE AND NARROW ROAD. GOLDEN GATE CAÑON.

FIG. 11.—BROKEN BRIDGE. GIBBON CAÑON.

FIG. 12.—ROAD ALONG GIBBON RIVER. FREQUENTLY OVERFLOWED.

FIG. 12*b*.—ROAD ALONG GIBBON RIVER. AFTER SPRING FLOOD.

FIG. 12C.—ROAD ALONG GIBBON RIVER. RECENTLY OVERFLOWED AND PARTIALLY REBUILT.

FIG. 13.—FORD OVER LEWIS RIVER, ON SNAKE RIVER ROAD. BRIDGE REQUIRED AT THIS POINT.

FIG. 14.—PRESENT CONDITION OF SNAKE RIVER ROAD. SOUTHERN APPROACH.

FIG. 15.—DANGEROUSLY NARROW ROAD ON SHORE OF LEWIS LAKE. SOUTHERN APPROACH.

FIG. 16.—RAPIDS OF YELLOWSTONE ABOVE UPPER FALLS. PROPOSED BRIDGE AT HEAD OF RAPIDS IN EXTREME BACKGROUND OF PICTURE.

FIG. 17.—BRIDGE SITE OVER THE YELLOWSTONE. LOOKING UP.

FIG. 18.—BRIDGE SITE OVER THE YELLOWSTONE. LOOKING DOWN.

FIG. 18*a*.—BRIDGE SITE OVER THE YELLOWSTONE. LOOKING DOWN. (LARGE VIEW.)

FIG. 19.—VIRGINIA CASCADE HILL. LOOKING UP. ROAD EXCEEDINGLY STEEP, ALTHOUGH IT DOES NOT LOOK SO IN THE PICTURE.

FIG. 20.—VIRGINIA CASCADE HILL. LOOKING DOWN. ROAD DANGEROUSLY STEEP AND NARROW

FIG. 21.—THE "DEVILS ELBOW." ROAD NARROW, CURVE DANGEROUSLY SHORT, AND ROAD FREQUENTLY WASHED OUT BY RIVER.

FIG. 22.—ROAD, NORRIS TO CAÑON, ON TOP OF HILL. JUNE 13, 1899.

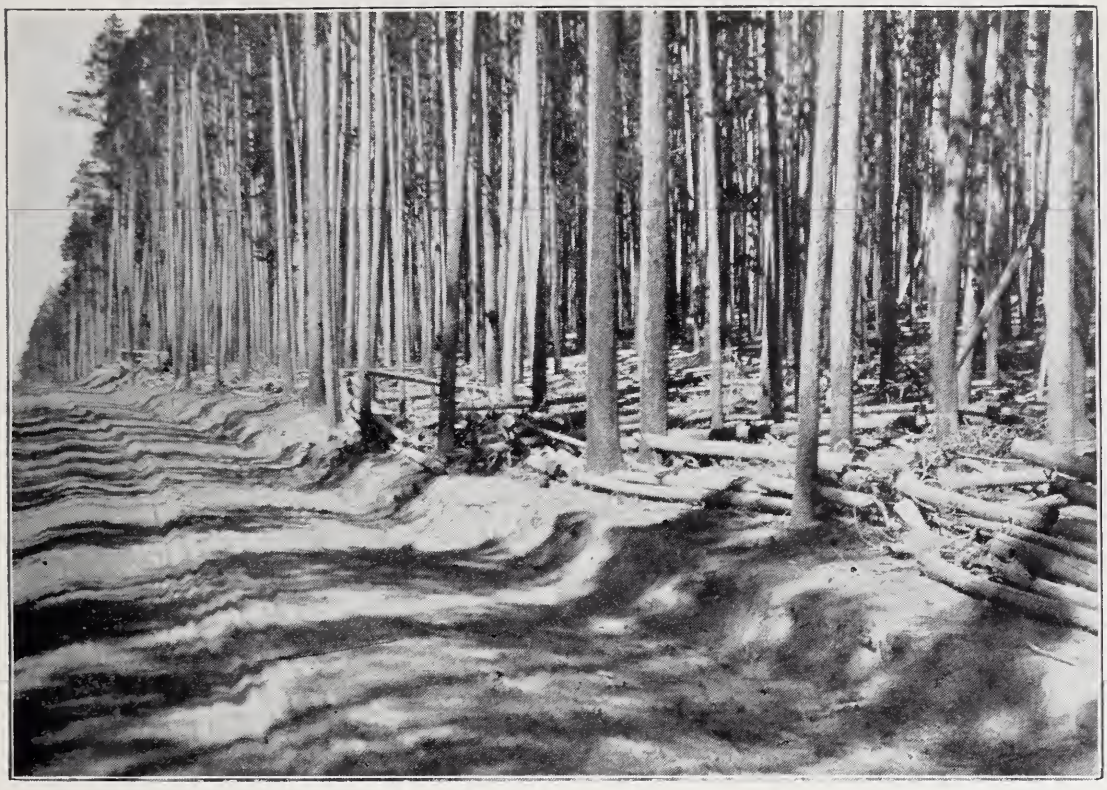

FIG. 23.—DENSE FORESTS WHICH HOLD SNOW ALONG ROAD FROM NORRIS TO CAÑON. TAKEN IN SEPTEMBER.

FIG. 24.—ROAD, NORRIS TO CANON, ON TOP OF HILL. JUNE 13, 1899.

FIG. 25.—DIFFICULT COUNTRY FOR ROAD CONSTRUCTION. ON LINE OF PROPOSED ROAD OVER MOUNT WASHBURN, VICINITY OF TOWER CREEK.

FIG. 26.—SCENERY ON MOUNT WASHBURN ROAD OPPOSITE TOWER CREEK.

FIG. 27.—PROPOSED BRIDGE SITE OVER LAMAR RIVER. (SEE FIGS. 29 AND 30.)

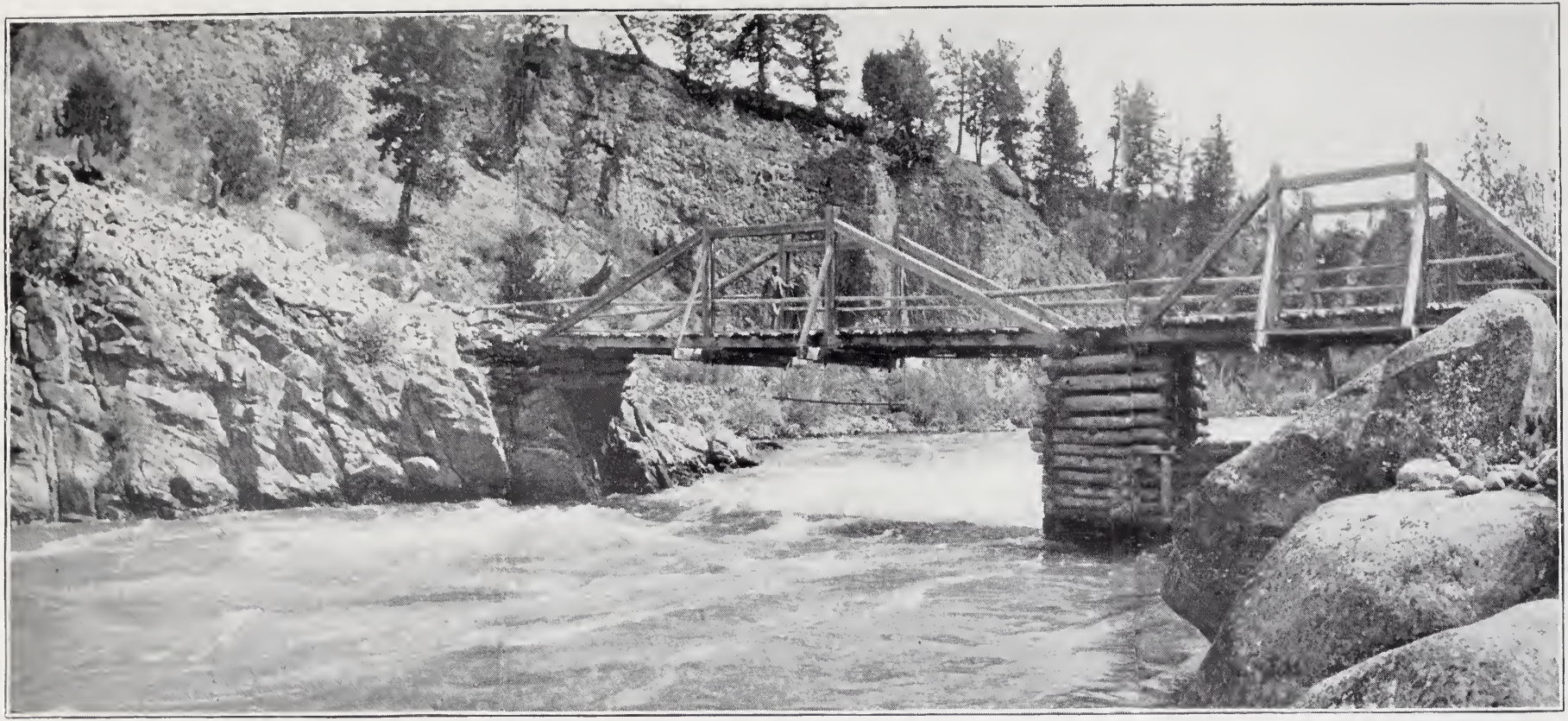

FIG. 28.—BARONET BRIDGE, YELLOWSTONE RIVER. NOW UNSAFE FOR HEAVY LOADS.

FIG. 29.—PRESENT BRIDGE OVER LAMAR RIVER. LOOKING DOWNSTREAM.

FIG. 30.—PRESENT BRIDGE OVER LAMAR RIVER. LOOKING UPSTREAM.

FIG. 31.—UNITED STATES ENGINEER OFFICE, MAMMOTH HOT SPRINGS, WYO.

Before construction.

After construction.

FIGS. 32, 33.—ROAD WORK IN PARK DURING SUMMER OF 1899.

FIG. 34.—VIEW OF SAME POINT AS IN FIGS. 32 AND 33. LOOKING EAST.

FIG. 35.—NEW ROAD DOWN GOLDEN GATE HILL. BUILT SUMMER OF 1899.

FIG. 36.

FIG. 37.

The above pictures were taken on the road between the Grand Cañon and the lake on the 13th of June, 1899, two days before the opening of the tourist season, and illustrate some of the difficulties and expense incurred each year in preparing the roads for travel. The difficulty is not so much in getting through the drifts as in the damage to the soft roads from the melting snow after travel begins. With macadamized roads this difficulty would disappear.

FIG. 38.—FALLEN TIMBER. ON LINE OF NEW ROAD FROM MAMMOTH HOT SPRINGS TO GOLDEN GATE.

FIG. 39.—TOP OF MAMMOTH HOT SPRINGS FORMATION. ON LINE OF NEW ROAD UP THE GOLDEN GATE HILL.

FIG. 40.—FOOT OF MAMMOTH HOT SPRINGS FORMATION. LINE OF NEW ROAD UP GOLDEN GATE HILL.

ANNUAL REPORT OF CAPT. H. M. CHITTENDEN, CORPS OF ENGINEERS, UPON IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES, FOR THE FISCAL YEAR ENDING JUNE 30, 1899.*

UNITED STATES ENGINEER OFFICE,
St. Louis, Mo., July 6, 1899.

GENERAL: I have the honor to submit herewith my annual report for the fiscal year ending June 30, 1899, upon the work of improvement of the Yellowstone National Park. My assignment to charge of this work dates only from the 25th of March last. The work not having been under the charge of the Corps of Engineers for several years past, the operations for that portion of the year prior to the above date will, it is presumed, be duly reported through the proper department. Only $5,000 of the current appropriation (act of March 3, 1899) was made available before July 1, and this has been expended almost entirely in the regular spring repairs upon the road system. The extraordinary lateness of the season—the latest known in the history of the Park—has deferred even these minor operations beyond any previous experience and has carried them into the next fiscal year. There is little, therefore, in the way of actual work to report since I took charge.

The annual repairs, including opening the roads through the snows which lay very heavy on the higher sections of the road system, were actively prosecuted during the month of June. A veritable winter climate prevailed throughout the upper Park during the first half of the month, snowstorms being of almost daily occurrence. The melting of the snows and the frequent storms left the ground in many places thoroughly soaked, at the very time when the heavy supplies for the hotels were being hauled into the Park. It has been with much difficulty, therefore, that the roads, which as yet are composed for the most part only of the soil through which they pass, have been placed in fairly passable condition in time for the opening of the tourist season. The accompanying photographs will convey some idea of the difficulties encountered in this work. The ordinary method of doing this preliminary work, based upon many years' experience, is to send out parties at as early a day as practicable to shovel a passage through the deepest snows and then to follow up this work, as soon as the snow is mainly gone, with one or two considerable parties equipped for regular road work. These parties open and repair damaged culverts; repair the bridges, clear away landslides and fallen timber, smooth up the road surface with grading machines, repair retaining walls, and do whatever else is rendered necessary by the action of the elements during the long and

*The photographs that accompanied this report are printed among those preceding this page.

severe winters which prevail in this region. As a general thing, fair weather follows closely upon this preliminary work and is the most important factor in putting the roads in good order. Under such circumstances, two or three weeks' work suffices to place the system in as good condition as it is susceptible of.

In other years, when the seasons are late and the snow melting and resultant storms continue after the spring traffic has opened, the problem is far more serious. The experiment has been tried this year on a small scale of posting section gangs at intervals throughout the Park, similar to those on railroads. Only moderate results are looked for, however, in this direction. The road system is not yet in a state of efficiency to make it a complete success. With macadamized pikes the system of small repairs by section crews would undoubtedly be the best, but now the repairs so often amount to actual reconstruction that small parties are incompetent to handle them. The section plan is being tried upon the urgent recommendation of several parties who understand the needs of the Park thoroughly from long residence here, and doubtless considerable benefit will result from the trial.

In addition to the current repair work, plans have been matured for the new work of the season which will be begun promptly upon the opening of the new fiscal year. This work will consist mainly in the building of a new road of about 3 miles length between Mammoth Hot Springs, Wyo., and Golden Gate. This line has been selected after several personal examinations by the officer in charge, and is now being laid out by instrumental surveys preparatory to commencement of the work.

In making up the estimates for the ensuing year in accordance with the customs and regulations of the Engineer Department, to which this work is now returned after the experiment of withdrawal during a period of four and one-half years, it will contribute to a better understanding of the magnitude and importance of the work if a brief sketch of its origin and development is given.

The discoverers of this region in 1870 found numerous trails of infrequent use, made by the Indians, passing over several of the routes now followed by the regular highways. As travelers became attracted here in the early seventies, saddle trails developed leading to the principal localities of interest. The main trail led from the Mammoth Hot Springs, via Mount Washburn, to the falls of the Yellowstone, crossing thence by the now abandoned Mary Mountain route to the Firehole Geyser Basins, where it was joined by another trail coming in from the valley of the Madison on the west. During the superintendency of Colonel Norris, 1878–1882, several wagon trails (mere passage ways for wagons, with no grading except where absolutely necessary) were built, and the present general line was opened from the Mammoth Hot Springs to the Upper Geyser Basin, with a line across Mary Mountain to the lake and canyon. In 1883 the roadwork was formally assigned to Lieut. D. C. Kingman, Corps of Engineers, by whom the project for the Park road system, as it has since been worked out, was prepared. Lieutenant Kingman himself made an important commencement to this work.

The project for a system of tourist routes to the various points of interest in the Yellowstone National Park, as proposed by Lieutenant Kingman, and slightly modified since, embraces a belt line which makes a general circuit of the Park, approaches by which the belt line is reached from various points on the Park boundary, and side roads to scattering points of interest. To these might also be added the numer-

ous trails used mainly by scouts and troops in protecting the Park, but involving little if any outlay for construction or maintenance.

The Belt Line, as proposed, includes Mammoth Hot Springs, Norris Geyser Basin, the Firehole Geyser Basins, the Yellowstone Lake, the Grand Canyon, and the section near Tower Falls below the Grand Canyon at the northern base of Mount Washburn. Between Norris and the Grand Canyon there is a crossroad which will always be of use for freight, even when the Belt Line is complete and tourist travel no longer passes over it.

The main approaches will probably not exceed one on each side of the Park. Of these the principal one now is on the north via the Gardiner River to Mammoth Hot Springs; this is the Northern Pacific connection.

The next most important approach is from the west via the Madison Valley. The Utah Northern connection is here, although the railroad is a day's journey from the boundary of the Park.

The southern approach leads up the valley of the Snake River from the celebrated locality known as Jackson Hole, and joins the Belt Line at the Yellowstone Lake. With a southern railroad connection, this will be an important approach.

On the east there is no regular approach. There is a road to the northeast corner of the Park from near Tower Falls, but it is used almost exclusively by miners located just outside the boundary. It is probable that before many years it may be necessary to make an approach from Big Horn Basin via Jones's Pass to the outlet of the Yellowstone Lake. The necessity for such a road, however, will be contingent upon the advent of a railroad in the Basin, and it is, therefore, not included in the present estimate.

SIDE ROADS.

There are several of these, and there will be many more. Some are passable by wagons, others only by saddle horses. The principal ones are as follows: Around the formation of Mammoth Hot Springs; to Bunsen Peak and the Middle Gardiner Falls; to the various objects of interest in the Firehole Geyser Basins; to the Lone Star Geyser; to the Natural Bridge, near the Yellowstone Lake; to Sulphur Mountain, and along the brink of the Grand Canyon of the Yellowstone below the Falls.

The total mileage of the projected system is about 300 miles.

Of the foregoing project the following portions are now completed in the form of an ordinary graded dirt road 18 feet wide:

The Belt Line is complele, with the exception of the portion from the Grand Canyon, via Tower Falls, to within 3½ miles of Mammoth Hot Springs. The four approaches are all passable by wagons, but only portions of all except the northern approach are completed. Not more than one-third of the work is done on the other three which is required to place them in as good condition as the other roads in the Park. Several of the side roads are open, but they are nearly all of the simplest form of construction that will make a passable driveway.

The work still remaining to be done to complete the project is as follows:

Belt Line.—A new road of about 3 miles in length, to cut out the very severe grades between Mammoth Hot Springs and the Golden Gate; about a half mile of new road in Gibbon Canyon, to cut out some heavy grades there; the raising of about 3 miles of the present road in that

vicinity, to protect it from floods in the Gibbon River; the construction, or rather completion, of about 4 miles of road near the Fountain Hotel; the construction of about 8 miles of road from Bluff Point, on the Yellowstone Lake, to Bridge Bay, and the construction of a new road from the Grand Canyon, via Tower Falls, to the East Gardiner Falls.

On the northern approach about 1½ miles of new road is required to diminish existing grades and eliminate a stretch that is dangerous from overhanging cliffs of loose rock. On the western approach about 4 miles of road remain to be constructed. The southern approach has been grubbed and cleared, but remains to be graded—in all, about 20 miles of work. On the eastern approach there remain about 15 miles of new work to be done, including two large bridges.

Of the side roads the most important still unfinished is a road for 2 or 3 miles down the Grand Canyon on the right bank. This will involve the construction of a costly bridge over the Yellowstone.

The bridges throughout the Park have hitherto all been constructed of wood. Although they have answered their purpose admirably, many need to be replaced, and this should now be done with the most approved steel structures with masonry abutments.

The project as above outlined does not include macadamizing the roads. It has been assumed that this would be done along with the annual work of maintenance and repairs. This improvement is, however, an absolutely essential feature of the road system, for the soil is such that it is impossible to maintain the roads in good condition in either the wet or dry portions of the year.

Of the new plant, which is essential to the care and maintenance of the road system, a rock-crushing outfit, concrete-mixing plant, and complete derrick outfit are immediately needed.

Although the work on the road system involves nearly 90 per cent of the annual expenditure of public money in the Park, the pressure for new work has always been so great that it has never been possible to provide a suitable office. That now used is a miserable excuse for an office building, having been knocked together at odd times from the crudest and cheapest materials. A good office, messhouse, and a warehouse are necessary to the proper execution of the work.

Below is an estimate of the amount required for the completion of the existing project after the work of the present season is done:

New road in Gardiner Canyon, including 3 steel bridges	$10,000.00
Road through Golden Gate Canyon, including a new steel bridge, to replace wooden bridge around cliff, and widening road along cliff, the latter all solid rock	15,000.00
Raising 3 miles of road in Gibbon Canyon, and cutting out 1 mile of dangerous grades; also opening 4 miles of new road down the Gibbon to connect with western approach	16,000.00
Completion of 8 miles of road near Fountain Hotel	8,000.00
Completion of southern approach along Snake River, 20 miles	20,000.00
New road from West Thumb to Natural Bridge, cutting out present line around Lake Shore, 8 miles	16.000.00
Surfacing new road from Lake Hotel to Grand Canyon, 15 miles	15,000.00
New bridge across the Yellowstone, near the Falls	20,000.00
New road down right bank of Grand Canyon, 3 miles	6,000.00
New road near Grand Canyon to cut out dangerous hills	5,000.00
New road, Canyon to Norris, 10 miles	20,000.00
New road, Grand Canyon, via Tower Falls, to Mammoth Hot Springs, 36 miles	72,000.00
New bridge over Yellowstone near Tower Falls	10,000.00
New bridge over Lamar River	5,000.00
Completion of east approach, 15 miles	15.000.00
New plant	5,000.00
New office and other buildings	5,000.00

Current repairs and maintenance for season of 1900	$10,000.00
New bridges at various points, 6 needed at once	12,000.00
Office, transportation, and miscellaneous expenses	10,000.00
There should also be added for clearing out and rendering more easily passable the numerous trails throughout the Park, which are essential to its proper police and protection	5,000.00
Total for completion of project in a single season	300,000.00

The superintendent has submitted to me the following estimate of improvements which have become necessary to facilitate his work in protecting the Park:

Two new station houses for troops at detached points in Park	$1,912.50
Four and one-half miles of fence along north boundary, to keep game in and cattle out, in the vicinity of the village of Gardiner, Mont	3,250.00
Station house and entrance gate at northern entrance to Park, where tourists mostly arrive	1,200.00
Surveying, monumenting, and otherwise marking boundaries, 59 miles at $75	4.425.00
	10,787.50
Total appropriation recommended for next fiscal year	310,787.50

There is thus needed to complete the necessary improvement of the Park, if done in a single season, not less than $310,000. After that the annual cost of the Park road system will be that of maintenance only. This, at first, may amount to $100 per mile per year—a very small cost—and even this will diminish with time as the roads become thoroughly macadamized.

In recommending that this sum be appropriated at once, either directly or by authorized contracts, the good of the work itself has not alone been consulted, but economy of cost to the Government as well. It is certain that to complete the project under the present system of small appropriations will cost the Government twice the above sum. As it now is, only small pieces of new work can be taken up in any one year. It has several times happened that practically the whole appropriation has gone into annual repairs. Such work as it is found possible to undertake has nearly always been left in a partially completed state, in which it is so much damaged by the severe winters that a good part of it has to be done over again. Only once in the history of the work has it been possible to make any really rapid progress toward its completion; that was in the season of 1891, when two appropriations, aggregating $150,000, were available. Nearly 60 miles of road were constructed at that time. It is not possible to get a start with the present system of small appropriations, and the officer in charge is every year confronted with the dilemma of having to abandon all new work and spend the money in necessary repairs, or let the roads go to pieces if he undertakes any new work. Every consideration of economy to the Government and advantage to the work will be promoted by providing at once the sum necessary to complete this project. If this can not be done by a direct appropriation, then the next best plan would be to authorize contracts to the amount of the balance not directly appropriated. If the latter method were adopted, 10 per cent ought to be added to the above estimate.

In regard to the purposes for which this money is being expended, it may safely be said that no public work is better justified by the results so far realized. The Park itself is fulfilling the purpose of its creation beyond the expectation of its most sanguine advocates. As a refuge of the native fauna of the continent it is an unqualified success. As a

resort for pleasure seekers and those interested in natural curiosities it has continually grown in public favor. Its administration, protection, and methods of caring for tourists have developed into a comprehensive and admirable system. Congress may therefore rest assured that an appropriation for the completion of the approved project of improvement of the Yellowstone National Park will be in every sense a judicious expenditure.

It is not possible in this report to present a precise statement of the cost of the existing project since its adoption in 1883, for in the earlier years, as well as in the four just past, the appropriations have gone in part to other purposes. At the close of the present season's work a complete statement of these expenditures will be worked up from the records. The amount, however, will vary but little from $650,000, which, with the $300,000 herein asked for and the $40,000 to be expended during the present season, will make the cost of the completed project fall within $1,000,000. A very considerable part of this sum, however, has been used in repairs, maintenance, and reconstruction, and the actual first cost of the project will probably not exceed $750,000.

Money statement.

March 25, 1899, when work was turned over to Engineer Department, balance unexpended	$1,581.33
Allotted from appropriation, sundry civil act of March 3, 1899 ($5,000 immediately available)	35,500.00
	37,081.33
June 30, 1899, amount expended under Engineer Department during fiscal year	1,697.55
July 1, 1899, balance unexpended	35,383.78
July 1, 1899, outstanding liabilities	4,883.78
July 1, 1899, balance available	30,500.00
Amount required for completion of existing project	310,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	310,000.00
Total amount expended on existing project to June 30, 1899, is (approximately)	650,000.00

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

List of civilian engineers employed on work of improvement in Yellowstone National Park, Wyoming, from July 1, 1898, to June 30, 1899, inclusive, under sundry civil acts of July 1, 1898, and March 3, 1899, for 1899 and 1900.

Name and residence.	Time employed.		Compensation per month.	Where employed.
	Mos.	*Days.*		
C. Sherman, Columbus, Ohio	.....	20	$150	Yellowstone National Park.
A. E. Burns, Mammoth Hot Springs, Wyo.	2	.....	125	Do.

Abstract of proposals to furnish teams and saddle and pack animals, opened at Mammoth Hot Springs, Wyo., June 15, 1899, by Capt. H. M. Chittenden, Corps of Engineers.

	Number, more or less.	No. 1. J. M. Lloyd.	No. 2. T. F. Callaghan, Mammoth Hot Springs, Wyo.	No. 3. C.B. Scott, Gardiner.
		Per day.	*Per day.*	*Per day.*
Four-horse teams, with driver	5	$5.30	$5.60	$5.00
Four-horse teams, without driver	5	3.80	No bid.	3.50
Single teams, with driver	30	3.40	3.60	3.25
Single teams, without driver	30	1.90	No bid.	1.75
Saddle horses	5	.42	1.00	.45
Pack animals	12	.42	1.00	.45

The amount available under this contract is $35,500.

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